WHAT IS CLAIMED IS:

1. An MRI system comprising:

time phase setting means for setting a plurality of different cardiac time phases of an object;

scanning means for starting an MR imaging scan in turn at each of the plurality of different cardiac time phases set by the time phase setting means so as to acquire a plurality of sets of echo data; and

image producing means for producing an image of one of fluid residing in a region to be scanned of the object and a parenchymal portion of the object influenced by the fluid from the plurality of sets of echo data acquired by the scanning means.

2. The MRI system of claim 1, wherein the plurality of different cardiac time phases are two time phases falling into a systole and a diastole of a cardiac cycle of the object.

3. The MRI system of claim 2, wherein the scanning means consists of means for performing a first scan started at the time phase falling in the systole and a second scan started at the time phase falling in the diastole with regard to one of a same slice of the object and a same slice encode for the object, the first and second scans being based on a different pulse sequence from each other.

4. The MRI system of claim 3, wherein the first and second scans are scans each being based on a half-Fourier technique.

5. The MRI system of claim 4, wherein the first scan is composed of a scan depending on a pulse sequence generating an echo signal in order to map echo data in a central region of a first k-space, the central region forming a lower-frequency region in a phase-encode direction of the first k-space, and

the second scan is composed of a scan depending on a pulse sequence generating an echo signal in order to map echo data in one of a central region and both end regions other than the central region of a second k-space, the central region forming a lower-frequency region in a phase-encode direction of the second k-space and both of the end regions

forming a higher-frequency region in the phase-encode direction of the second k-space.

6. The MRI system of claim 5, wherein the image producing means has calculating means for calculating, with regard to each of the first and second k-spaces, additional echo data based on the half-Fourier technique so that the calculated echo data are mapped in each of the first and second k-spaces for each of which the echo data are acquired with the first and second scans, respectively, and duplicating means for duplicating, into a remaining region of the first k-space in which echo data is not mapped, echo data existing in a corresponding region of the second k-space to the remaining region of the frost k-space.

7. The MRI system of claim 6, wherein the image producing means includes arterial phase image producing means for obtaining one of echo data and image data representing an arterial phase image by executing calculation between one of echo data of the first k-space and image data thereof and one of echo data of the second k-space and image data thereof.

8. The MRI system of claim 7, wherein the calculation executed by the arterial phase image producing means is one of subtraction, weighted difference calculation, and addition.

9. The MRI system of claim 7, wherein the image producing means includes venous phase image producing means for obtaining one of echo data and image data thereof representing a venous phase image by executing subtraction between one of echo data of image data representing the arterial phase image obtained by the arterial phase image producing means and one of echo data of the second k-space and image data thereof.

10. The MRI system of claim 1, wherein the MR imaging scan is either one of a two-dimensional scan and a three-dimensional scan.

11. The MRI system of claim 1, wherein the scanning means is

composed of means that executes the MR imaging scan with a pulse sequence based on one of a FASE (Fast Asymmetric SE) technique, EPI (Echo Planar Imaging) technique, and FSE (Fast Spin Echo) technique.

12. The MRI system of claim 2, wherein the time phase setting means has detecting means for detecting a signal indicative of the cardiac time phases of the object, preparing means for obtaining a plurality of MR images by executing a preparing MR sequence a plurality of times for a region to be imaged of the object at different timings from a heartbeat reference wave appearing cyclically in the signal detected by the detecting means, and means for determining the two time phases from the plurality of MR images obtained by the preparing means.

13. The MRI system of claim 12, wherein the signal indicative of the cardiac time phases is an ECG signal of the object and the heartbeat reference wave is an R-wave of the ECG signal.

14. An MR imaging method comprising the steps of:

setting a plurality of different cardiac time phases of an object;

acquiring a plurality of sets of echo data through an MR imaging scan started at each of the plurality of different cardiac time phases in turn; and

producing an image of one of fluid residing in a region to be scanned of the object and a parenchymal portion of the object influenced by the fluid from the plurality of sets of echo data.

15. The MRI system of claim 1, wherein the scanning means has means for executing a pulse sequence including readout gradient pulse of which applied direction is substantially parallel to a moving direction of the fluid.

16. The MRI system of claim 15, wherein the readout gradient pulse has a main pulse used for reading out the echo signal and a control pulse added to the main pulse and used for controlling behaviors in phase of magnetic spins of the fluid.

17. The MRI system of claim 16, wherein the control pulse is a pulse responsible for at least one of dephasing and rephasing of the magnetic spins.

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18. The MRI system of claim 16, further comprising means for controlling an intensity of the control pulse in accord with a flow velocity of the fluid.

19. An MRI system that executes a scan based on a pulse sequence including a readout gradient pulse toward an object placed in a static magnetic field, comprising:

scanning means for performing the scan to acquire an echo signal with an applied direction of the readout gradient pulse substantially parallel to a moving direction of fluid in motion within the object; and

image producing means for producing, from the echo signal, an image of one of the fluid and a parenchymal portion of the object influenced by the fluid.

20. An MRI system that executes a scan based on a pulse sequence including a readout gradient pulse toward an object placed in a static magnetic field, comprising:

time phase setting means for setting a cardiac time phase of the object;

scanning means for performing the scan to acquire an echo signal in accord with the cardiac time phase, under a condition that an applied direction of the readout gradient pulse is substantially parallel to a moving direction of fluid in motion within the object; and

image producing means for producing, from the echo signal, an image of one of the fluid and a parenchymal portion of the object influenced by the fluid.

21. The MRI system of claim 20, wherein the readout gradient pulse has a main pulse used for reading out the echo signal and a control pulse added to the main pulse and used for controlling behaviors in phase of magnetic spins of the fluid.

22. The MRI system of claim 21, wherein the control pulse is a pulse responsible for at least one of dephasing and rephasing of the magnetic spins.

23. The MRI system of claim 20, wherein the time phase setting means is composed of mans for setting two cardiac time phases of the object,

the scanning means is composed of acquiring data consisting of two sets of echo signals by scanning the object on the basis of first and second scans at the two cardiac time phases, respectively; and

the image producing means is composed of means for producing an image of the fluid from the data.

24. The MRI system of claim 23, wherein the scanning means is composed of means that performs the first and second scans through two times of scanning.

25. The MRI system of claim 24, wherein the readout gradient pulse has a main pulse used for reading out the echo signal and a control pulse added to the main pulse and used for controlling behaviors in phase of magnetic spins of the fluid.

26. The MRI system of claim 25, wherein the control pulse is a pulse responsible for at least one of dephasing and rephasing of the magnetic spins.

27. The MRI system of claim 26, wherein the control pulse of the readout gradient pulse of the pulse sequence used for each of the first and second scans executed at the two cardiac time phases is formed as a pulse responsible for at least one of the dephasing and rephasing.

28. The MRI system of claim 26, wherein the control pulse of the readout gradient pulse of the pulse sequence used for the first scan executed at one of the two cardiac time phases is formed as a pulse responsible for the dephasing and the control pulse of the readout gradient pulse of the pulse sequence used for the second scan executed

at the other cardiac time phase is formed as a pulse responsible for the rephasing.

29. The MRI system of claim 28, wherein the time phase setting means is composed of means that sets a time phase falling into a diastole of the object as the one cardiac time phase and sets another time phase falling into a systole of the object as the other cardiac time phase.

30. The MRI system of claim 25, wherein the control pulse is changeable in its wave area.

31. The MRI system of claim 23, wherein the scanning means consists of means for sequentially performing the first and second scans during one time of imaging set based on one of a same slice of the object and a same slice-encode amount for the object.

32. The MRI system of claim 31, wherein the readout gradient pulse has a main pulse used for reading out the echo signal and a control pulse added to the main pulse and used for controlling behaviors in phase of magnetic spins of the fluid.

33. The MRI system of claim 32, wherein the time phase setting means is composed of means that sets, as the two cardiac time phases, two cardiac time phases each falling into a systole and a diastole of a heart of the object.

34. The MRI system of claim 33, wherein the control pulse is a pulse responsible for dephasing the magnetic spins at one cardiac time phase in the systole and a pulse responsible for rephasing the magnetic spins at the other cardiac time phase in the diastole.

35. The MRI system of claim 31, wherein the control pulse is changeable in its wave area.

36. The MRI system of claim 20, wherein the fluid is a blood flow of the object.

37. The MRI system of claim 36, wherein the blood flow consists of an artery and a vein slowly flowing in an inferior limb of the object, and

the image producing means is composed of artery/vein image producing means that produces images in which the artery and vein are shown separately.

38. The MRI system of claim 24, wherein the first and second scans are scans based on a half-Fourier technique.

39. The MRI system of claim 38, wherein the first scan is composed of a scan depending on a pulse sequence generating an echo signal in order to map echo data in a central region of a first k-space, the central region forming a lower-frequency region in a phase-encode direction of the first k-space, and

the second scan is composed of a scan depending on a pulse sequence generating an echo signal in order to map echo data in one of a central region and both end regions other than the central region of a second k-space, the central region forming a lower-frequency region in a phase-encode direction of the second k-space and both of the end regions forming a higher-frequency region in the phase-encode direction of the second k-space.

40. The MRI system of claim 39, wherein the image producing means has calculating means for calculating, with regard to each of the first and second k-spaces, additional echo data based on the half-Fourier technique so that the calculated echo data are mapped in each of the first and second k-spaces for each of which the echo data are acquired with the first and second scans, respectively, and duplicating means for duplicating, into a remaining region of the first k-space in which echo data is not mapped, echo data existing in a corresponding region of the second k-space to the remaining region of the frost k-space.

41. The MRI system of claim 40, wherein the image producing means includes arterial phase image producing means for obtaining one of echo data and image data representing an arterial phase image by

executing calculation between one of echo data of the first k-space and image data thereof and one of echo data of the second k-space and image data thereof.

42. The MRI system of claim 41, wherein the calculation executed by the arterial phase image producing means is one of subtraction, weighted difference calculation, and addition.

43. The MRI system of claim 41, wherein the image producing means includes venous phase image producing means for obtaining one of echo data and image data thereof representing a venous phase image by executing subtraction between one of echo data of image data representing the arterial phase image obtained by the arterial phase image producing means and one of echo data of the second k-space and image data thereof.

44. The MRI system of claim 38, wherein each of the first and second scans is either one of a two-dimensional scan and a three-dimensional scan.

45. The MRI system of claim 38, wherein the pulse sequence used by each of the first and second scans is composed of a train of pulses based on one of a FASE (Fast Asymmetric SE) technique, EPI (Echo Planar Imaging) technique, FSE (Fast Spin Echo) technique, and SE (Spin Echo) technique.

46. The MRI system of claim 38, wherein the time phase setting means has detecting means for detecting a signal indicative of the cardiac time phases of the object, preparing means for obtaining a plurality of MR images by executing a preparing MR sequence a plurality of times for a region to be imaged of the object at different timings from a heartbeat reference wave appearing cyclically in the signal detected by the detecting means, and means for determining the two time phases from the plurality of MR images obtained by the preparing means.

47. The MRI system of claim 46, wherein the signal indicative of

the cardiac time phases is either an ECG signal and PPG signal of the object and the heartbeat reference wave is an R-wave of either of the ECG signal and the PPG signal.

48. The MRI system of claim 21, comprising means for controlling an intensity of the control pulse in accord with a flow velocity of the fluid.

49. An MR imaging method comprising the steps of:

setting a cardiac time phase of an object;

performing a scan in accord with the cardiac time phase with use of a pulse sequence a readout gradient pulse of which applied direction is substantially parallel to a moving direction of fluid in motion within the object, so that an echo signal is acquired; and

producing, from the echo signal, an image of one of the fluid and a parenchymal portion of the object influenced by the fluid.

50. The MR imaging method of claim $\boxed{48}$, wherein the readout gradient pulse has a main pulse to read out the echo signal and at least one of a dephase pulse and a rephase pulse responsible for dephasing and rephasing phases of magnetic spins of the fluid, respectively, the at least one pulse being added to the main pulse.

51. An MRI system comprising:

a magnet for generating a static magnetic field in which an object is placed;

an RF coil device through which an RF magnetic field is transmitted to the object and an echo signal emanated from the object is received;

a transmitter for transmitting the RF magnetic field to the object through the RF coil device, the RF magnetic field being based on a pulse sequence;

a gradient power supply for applying a gradient based on the pulse sequence to the object through a gradient coil;

a receiver for receiving the echo signal through the RF coil device, the echo signal being generated in response to performance of the pulse

sequence;

a calculating unit for producing the echo signal received by the receiver into an image; and

a controller for controlling operations of the transmitter, receiver and gradient power supply in conformity with the pulse sequence,

wherein the controller executes, as the pulse sequence, a pulse sequence for a preparatory scan to set a plurality of different cardiac time phases of the object and a pulse sequence for an imaging scan in synchronism with each of the plurality of different cardiac time phases in turn, and

the calculating unit produces an image of one of fluid present in a region to be scanned of the object and a parenchymal region of the object influenced by the fluid from a plurality of sets of the echo signal acquired correspondingly to each of the plurality of different cardiac time phases.

52. The MRI system of claim 51, wherein the plurality of different cardiac time phases are two time phases each falling into each of a systole and a diastole of a cardiac cycle of the object.

53. An MRI system comprising:

a magnet for generating a static magnetic field in which an object is placed;

an RF coil device through which an RF magnetic field is transmitted to the object and an echo signal emanated from the object is received;

a transmitter for transmitting the RF magnetic field to the object through the RF coil device, the RF magnetic field being based on a pulse sequence;

a gradient power supply for applying a gradient based on the pulse sequence to the object through a gradient coil;

a receiver for receiving the echo signal through the RF coil device, the echo signal being generated in response to performance of the pulse sequence;

a calculating unit for producing the echo signal received by the receiver into an image; and

a controller for controlling operations of the transmitter, receiver

and gradient power supply in conformity with the pulse sequence,

wherein the controller executes, as the pulse sequence, a pulse sequence for a preparatory scan to set a cardiac time phase of the object and a pulse sequence for an imaging scan in synchronism with the cardiac time phase, the imaging-scan pulse sequence including a readout gradient pulse of which applied direction being substantially parallel with a moving direction of fluid in motion within the object,

the calculating unit produces an image of one of the fluid and a parenchymal region of the object influenced by the fluid from the echo signal acquired through the receiver correspondingly to performance of the imaging-scan pulse sequence.

54. The MRI system of claim 53, wherein the readout gradient pulse has a main pulse to read out the echo signal and a control pulse added to the main pulse to control phase behaviors of magnetic spins of the fluid.

55. The MRI system of claim 54, wherein the control pulse is formed into a pulse responsible for at least one of dephasing and rephasing the magnetic spins.

56. The MRI system of claim 55, wherein the time phase consists of two cardiac time phases falling into a systole and a diastole of the object, respectively, and

the imaging scan consists of a first scan and a second scan started at the two cardiac time phases, respectively.

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